

# Using the Internet to Understand Angler Behavior in the Information Age

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**ABSTRACT:** *Declining participation in recreational angling is of great concern to fishery managers because fishing license sales are an important revenue source for protection of aquatic resources. This decline is frequently attributed, in part, to increased societal reliance on electronics. Internet use by anglers is increasing and fishery managers may use the Internet as a unique means to increase angler participation. We examined Internet search behavior using Google Insights for Search, a free online tool that summarizes Google searches from 2004 to 2011 to determine (1) trends in Internet search volume for general fishing-related terms and (2) the relative usefulness of terms related to angler recruitment programs across the United States. Though search volume declined for general fishing terms (e.g., fishing, fishing guide), search volume increased for social media and recruitment terms (e.g., fishing forum, family fishing) over the 7-year period. We encourage coordinators of recruitment programs to capitalize on anglers' Internet usage by considering Internet search patterns when creating web-based information. Careful selection of terms used in web-based information to match those currently searched by potential anglers may help to direct traffic to state agency websites that support recruitment efforts.*

## INTRODUCTION

Declining participation in outdoor activities is a pervasive concern in the United States (Kareiva 2008; Pergams and Zaradic 2008), garnering attention from a wide range of authorities

## El uso de internet para comprender el comportamiento de los pescadores en la era de la informática

**RESUMEN:** La declinación para participar en la pesca recreativa es un problema considerable para los manejadores de pesquerías, ya que la venta de licencias de pesca es una importante fuente de ingresos destinada a la protección de recursos acuáticos. Esta declinación con frecuencia se le atribuye, en parte, a que la sociedad depende cada vez más de la electrónica. El uso de internet por parte de los pescadores se está incrementando y los manejadores pesqueros pueden usar internet como un medio único para aumentar la participación de los éstos. Se examinó el comportamiento de búsqueda en internet mediante Google Insights, una herramienta en línea que resume las búsquedas hechas en Google durante el periodo 2004-2011, con el fin de determinar (1) tendencias en internet del volumen de búsqueda de términos generales relativos a la pesca, y (2) la utilidad relativa de términos relativos a programas de reclutamiento de pescadores, a lo largo de los EEUU. Los resultados apuntan a que a lo largo de un periodo de siete años si bien disminuyó el volumen de búsqueda de términos generales de pesca (p.e. pesca, guía de pesca), incrementó el volumen de búsqueda de medios sociales y términos relacionados al reclutamiento (p.e. foro de pesca, pesca familiar). Se invita a los coordinadores de programas de reclutamiento a capitalizar el uso que los pescadores le dan a internet, al momento de generar información disponible en red. Una selección cuidadosa de los términos que se incluyen en información disponible en la red de manera que coincida con el potencial de búsqueda de los pescadores, podría ayudar a dirigir el tráfico hacia las páginas electrónicas de las agencias estatales que patrocinan los programas de reclutamiento.

such as federal and state departments of health and education and authors of popular literary works (e.g., Louv 2005). Aside from public health concerns (McCurdy et al. 2010), declining participation in outdoor recreation has a direct and negative impact on natural resource protection. Many natural resource management agencies rely on permit sales, license sales, and usage fees to fund their efforts to maintain and protect natural areas. Declines in participation, and thus funds from license sales, can reduce the ability of these agencies to manage and protect natural resources.



**Photo 1. Family fishing day at the lake. Credit: Cliff Wilson.**

Like participation in outdoor recreation in general, participation in aquatic recreational activities such as boating and angling is declining (Pergams and Zaradic 2008), leaving natural resource management agencies with the need to market aquatic activities to the public. Decreasing angling participation (U.S. Fish and Wildlife Service et al. 2006) has prompted many state agencies to launch extensive angler recruitment and retention programs (e.g., Nebraska Game and Parks Commission 2008). These often center on activities such as children's and family fishing events and free fishing weekends but also include traditional marketing campaigns. Evidence supporting gains in angler participation as a result of these current angler recruitment and retention programs is lacking. In fact, angler participation continues to decline despite these programs (U.S. Fish and Wildlife Service et al. 2006).

Increased Internet and electronic media use are often identified as critical factors in declining participation in outdoor recreation (Pergams and Zaradic 2006). However, changing means of information gathering by anglers may require aquatic resource management agencies to rely on the Internet for increasing participation in aquatic recreation. For example, anglers once exchanged information about fishing at local cafes, bait shops, and boat ramps, but they now exchange this information through online forums, discussion boards, and Facebook groups. These platforms allow contemporary anglers an expanded array of methods for gathering and sharing information. Moreover, these online platforms provide real-time information, which may come directly from someone currently fishing.

The recent and rapid development of Internet and electronic media resources has outpaced fishery managers' abilities to understand and effectively use search engines, discussion boards, Twitter feeds, and Facebook groups to reach current and potential anglers (hereafter, "angler" will refer to current and potential anglers). We examined patterns of angler behavior as evidenced by

Internet search histories to better understand how the Internet might be used for angler recruitment and retention efforts. Specifically, we examined angler-related Internet search behavior using a free web-based tool (Google Insights for Search) that summarizes Google searches since 2004 to determine (1) trends in Internet search volume for general fishing-related terms and (2) the relative effectiveness of terms related to angler recruitment and retention programs found across the United States, based on Google search patterns.

## METHODS

### Google Insights for Search

Google Insights for Search (hereafter, Google Insights; <http://www.google.com/insights/search>) is a free, web-based tool that provides index scores for specified terms used in searches. Google Insights uses a proprietary algorithm to calculate a score for each search term that represents the likelihood a random Google user would search for that particular term (Google 2010). Google Insights can be used to compare search volume for up to five terms simultaneously and results can be filtered by any combination of category (entertainment, health, hobbies and leisure, news, etc.), location (worldwide, country, state, or metro), and time (any date range from 2004 to present). The search volume for these terms is then normalized so that the greatest value is set to 100 and all other values are scaled against that observation. Normalized scores are then averaged over the period searched to provide a single score for each search term. Consequently, mean normalized scores are directly comparable only among terms used within a given search.

Google searches are becoming a common source of current trend information in a number of disciplines. The rationale behind using search trends as a surrogate of actual trends is based on the idea that users (i.e., the general public) seek information for immediate use or action. For example, diseases such as influenza can be tracked both spatially and temporally using search volume to gather information before users actually report to the doctor for treatment (Ginsberg et al. 2009). Correlations between search volume and patient records also exist for kidney stone occurrence (Breyer et al. 2011) and the awareness of cancer following a celebrity death (Metcalf et al. 2011). In the social science literature, search volume has

**TABLE 1. List of search terms used to analyze anglers' use of Google searches for gathering information on fishing.**

Recruitment and retention terms	Fishing information terms	Social media terms
Free fishing	Fishing report	Fishing forum
Fishing clinic	Fishing conditions	Fishing blog
Fishing schools	Fishing guide	Fishing Twitter
Urban fishing	Fishing license	Fishing Facebook
Family fishing	Fishing rules	Fishing YouTube
Women fishing	Trophy fishing	
Kid fishing	Fishing tournament	

also been found to correlate with unemployment rates (Askitas and Zimmermann 2009) and perceptions of unemployment (Scheitle 2011).

## Data Collection and Analysis

Google Insights was accessed on December 15, 2011, and filtered using hobbies and leisure (category), outdoors (subcategory), United States (location), and 2004–present (time). We first examined the general search term “fishing” to explore seasonal trends and magnitude of search volume. We also examined temporal trends in 20 search terms selected by an ad hoc survey of fishery professionals and from one of three categories: (1) terms commonly used in current angler recruitment and retention programs throughout the country (e.g., Arizona Game and Fish Department 2009 and Tennessee Wildlife Resources Agency 2011), (2) fishing information gathering terms, and (3) social media terms (Table 1).

In addition to normalized scores for search volume, Google Insights returns a list of the top search terms. When these top searches included search terms with extraneous or irrelevant information, mathematical operators (+ and –) were employed to include or exclude certain words or phrases in search terms. For example, a Google Insights search for the term “Fishing report—weather,” would functionally serve as fishing report NOT weather, excluding searches that included weather from the results. Operators and terms added or excluded from searches are listed in Table 2; any references to particular search terms in discussion will exclude mention of operators.

Because mean normalized scores are not directly comparable across searches, we included either “fishing report” or “fishing forum” in every search to allow comparison of normalized scores across searches. We also compared search volume against time in days since January 11, 2004 (the earliest result displayed by Google Insight), using simple linear regression to evaluate the strength and direction of trends across the survey period.

## RESULTS

Overall, searches within the “outdoors” subcategory with the “hobbies and leisure” filter applied have declined since 2004. Fishing was the most-searched term in the outdoors subcategory (Table 2; Figure 1). Search volumes for fishing and terms directly related to fishing—such as fishing guide—decreased through the period (Table 2). Search volume for most of these terms followed an annual pattern, with the greatest search volume occurring during the late spring and summer and less volume during the fall and winter (Figure 2).

Among the 20 terms analyzed, search volume was greatest for “fishing,” followed by “fishing report,” “fish-

Since 2004, the search volume for general fishing terms (e.g., “fishing guide”) has declined. However, angling terms related to social media (e.g., “fishing Facebook”) and angler recruitment programs (e.g., “family fishing”) has increased.

**TABLE 2.** Google Insights for Search relative search volume score and slope and P-value of slope (from type I sum of squares) for the relationship between search volume and time (months since January 1, 2004). Clarifying search terms are joined to primary search terms with Boolean operators and are included in parentheses.

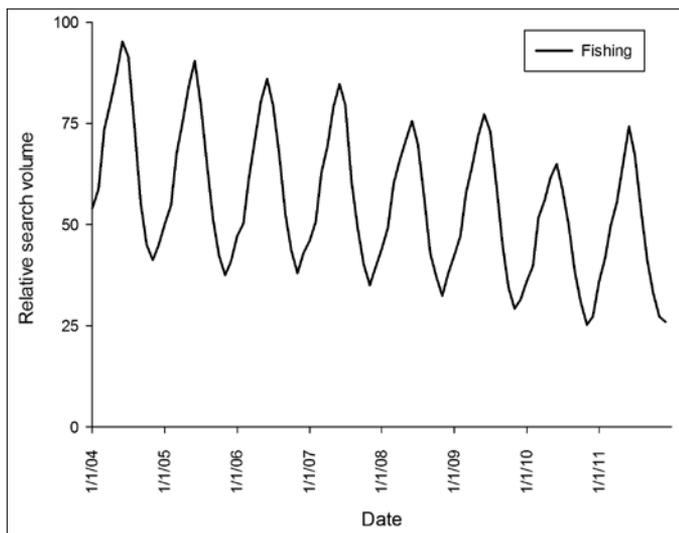
Term	Score	Slope	P-value
<b>Low return</b>			
Fishing Twitter	1	0.02	<0.0001
Urban fishing	3	0.01	0.28
Trophy fishing (NOT game)	6	0.04	0.34
Fishing clinic (AND fishing class AND fishing classes)	7	0.05	<0.0001
Fishing blog	7	0.08	<0.0001
Family fishing (NOT guy)	8	0.06	<0.0001
Women fishing (NOT pictures NOT photos NOT pics)	10	0.05	<0.001
Kid fishing (AND youth fishing AND junior fishing NOT games)	11	0.05	<0.0001
Fishing conditions	11	<-0.01	0.86
Fishing Facebook (NOT game)	20	0.37	<0.0001
Fishing school (AND fishing schools NOT high)	20	-0.01	0.73
Fishing YouTube	22	0.32	<0.0001
Free fishing (NOT online NOT games NOT game NOT videos NOT maps NOT boat NOT lures NOT tackle NOT map NOT tips)	30	-0.03	0.45
Fishing forum <sup>a</sup>	57	0.31	<0.0001
<b>Medium return</b>			
Fishing forum <sup>a</sup>	7		
Fishing tournament	8	-0.01	0.13
Fishing rules (AND fishing regulations)	12	-0.02	0.12
Fishing guide (NOT WOW <sup>b</sup> NOT Warcraft NOT cooking)	12	-0.06	<0.0001
Fishing license	40	0.13	0.04
Fishing report (NOT weather) <sup>c</sup>	63	0.09	0.13
<b>High return</b>			
Fishing report (NOT weather) <sup>c</sup>	5		
Fishing	58	-0.27	<0.0001

<sup>a</sup>Term included in searches to compare between low-return and medium-return searches.

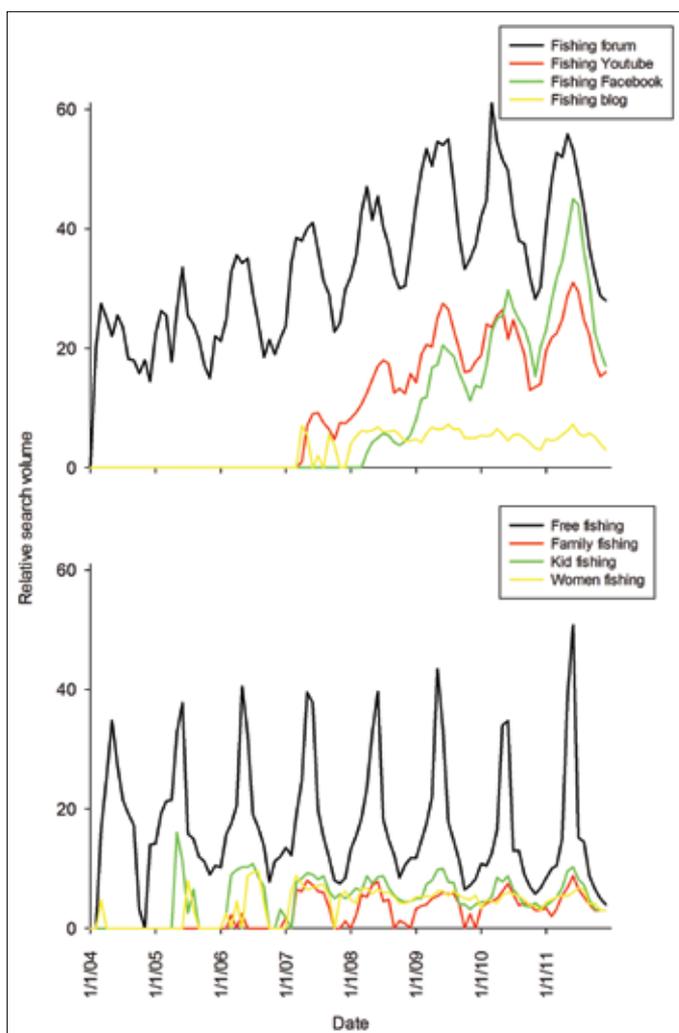
<sup>b</sup>WOW = World of Warcraft, a popular video game containing a fishing subroutine.

<sup>c</sup>Term included in searches to compare between medium-return and high-return searches.

ing license,” “fishing guide,” and “fishing rules” (Table 2). Internet search volume related to social media sites including “fishing Facebook,” “fishing Twitter,” and “fishing YouTube” increased over time (Table 2; Figure 2). Terms used in angler recruitment and retention programs were among the least searched in our study (e.g., “urban fishing,” “kid fishing,” “women fishing,” “fishing clinic,” “fishing school”) and all



**Figure 1.** Relative search volume for “fishing” in the outdoors category of Google Insights for Search from 2004 to present.



**Figure 2.** Relative search volume for four social media terms (top panel) and four recruitment and retention program terms (bottom panel) in the outdoors category of Google Insights for Search from 2004 to present.

ranked low in search volume (Table 2). However, search volume for these terms generally increased despite evidence of a declining interest in fishing overall (Table 2; Figure 2).

## DISCUSSION

Current and potential anglers use the Internet to find angling-related information as demonstrated by increasing search volume for fishing-related terms. For example, “fishing report,” a phrase that could be searched by an angler looking for local fishing conditions, had the highest relative score of any specific term searched in our study. Anglers also commonly use Internet resources as a means of exchanging fishing information, ranging from the basic “what, when, and where” questions of fishing in their area to the intricate questions of “how,” including information on fishing licenses, rules, and regulations.

Increases in search volume for fishing in social media outlets provide evidence that forums, blogs, and websites like YouTube and Facebook are becoming increasingly important to anglers. As Internet use on mobile phones increases, social media sites can provide a real-time exchange of information about current fishing conditions and a chance for anglers to share pictures and information while still on the water. Social media outlets appear to be used by both avid and casual anglers but are likely used by anglers in varying capacities (Recreational Boating and Fishing Foundation 2010), and understanding these differences in usage patterns is important for management agencies developing recruitment and retention programs. Casual anglers, for example, are more likely to post their angling experiences on Facebook and Twitter, whereas avid anglers are more likely to participate in discussions on angling blogs and outdoor forum discussion boards (Recreational Boating and Fishing Foundation 2010). Furthermore, there is a switch from use of general search terms such as “fishing” and “recreation” to specific fishing-related social media terms that may be indicative of a shift in the tools that anglers are using to find information. Natural resource management agencies should encourage the use of social media within their organizations and encourage the use of information exchange on social media sites. The private business sector, for example, has found social media presence to serve as a valuable means of advertisement (Mangold and Faulds 2009). This model may also prove valuable to natural resource management agencies.

Agencies using the Internet and electronic media in their recruitment and retention strategies must have a firm understanding of the search terms used by anglers to ensure that the target audience can find information about agency products. Understanding which terms are used in search queries by persons interested in fishing will allow natural resource management agencies to tailor website information to capitalize on existing patterns of angler behavior and ultimately increase information delivery to their target audience. Additionally, if agencies do not use common search terms to describe angler programs on the Internet, interested persons will have difficulty locating that information. Search engines can only search for those terms present on a website; consequently, information re-



Photo 2. First fish of the day. Credit: Cliff Wilson.



Photo 3. Learning about fish. Credit: Cliff Wilson.

garding angler recruitment and retention programs should be presented using unambiguous terms, avoiding jargon, to maximize the chances of potential anglers locating the information. Web pages presenting information on recruitment and retention events, for example, or programs phrased “free fishing” had greater search volume than programs phrased as “fishing clinic,” “urban fishing,” “women fishing,” and “kid fishing.” Existing agency programs may benefit from relabeling so they are more likely to include search terms used by anglers. For instance, Internet searches for “fishing guide,” a phrase used by many natural resource management agencies to describe documents containing fishing regulations, is used by persons seeking information on guided fishing trips. The inability of anglers to easily locate basic fishing information may lead to confusion, frustration, and potentially alienation. Studying fishing-related Internet searches allows for a simple analysis of the top searches for recruitment and retention terms, thus enabling state agencies to present or label information with the specific search terms used by anglers.

Google Insights can provide an understanding into angler behavior for natural resource management agencies that is now possible at previously immeasurable scales (Arlinghaus and Cooke 2008), although it does have two key limitations. First, the demographics of Internet users and the angling population may be different. Internet use is greater among younger generations (e.g., 87% by millennials) than older generations (e.g., 70% by older baby boomers; Jones 2009). The population of anglers is much older than the population of Internet users. We believe that this bias is minimal in the context of our study because our objective was to examine search terms related to recruitment programs and most recruitment programs are aimed at recruiting young anglers and keeping them in the angling population. Second, results from Google Insights are sensitive to search term selection. It is imperative to examine the top searches listed to look for influential outliers that may need to be excluded. For example, a search for “fishing guide” returns a top search of “wow fishing guide.” When searching for this term, we found that this is a user guide for a popular video game, World of Warcraft. Natural resource management agencies must be (as this example demonstrates) especially mindful of terminology used in their Internet sources of information.

Declining participation in outdoor recreation has left natural resource management agencies scrambling to find the new anglers to fund natural resource protection and management. The fate of this funding likely rests with younger people who regularly use the Internet to obtain information that will enhance and improve their activities in their day-to-day lives. Reaching the next generation will require natural resource management agencies to embrace these technologies rather than simply blaming technology for decreasing angler participation. Searches for outdoor recreational activities are increasing at a time when participation is decreasing, thus demonstrating that by eschewing the Internet natural resource agencies may be missing an opportunity and venue to recruit and retain anglers. Strategic use of the Internet now may help natural resource management agencies recruit the next generation of anglers and retain funding for the protection of our natural resources into the future.

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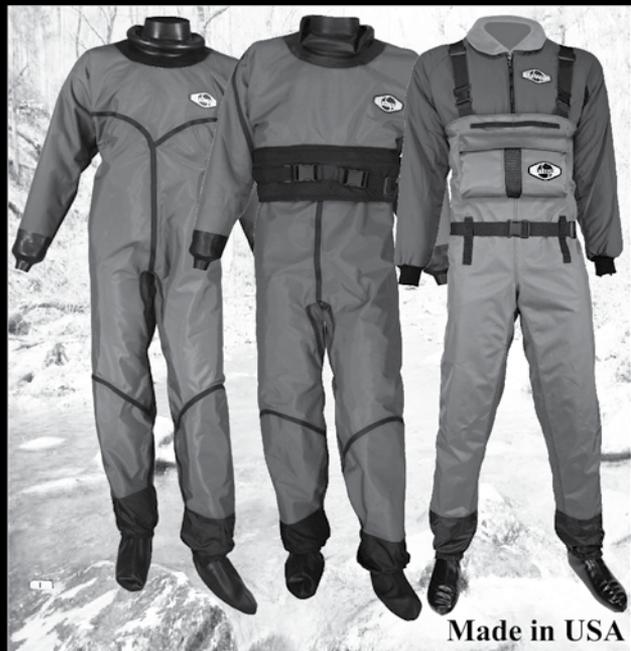


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